ZooKeys 955: 97–111 (2020)
doi: 10.3897/zookeys.955.52584
https://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Contributions to Chinese fauna of Torrenticolidae Piersig, 1902 (Acari, Hydrachnidia), with the description of three new species

Xin-Yao Gu[1], Lan Jia[1], Dao-Chao Jin[1], Jian-Jun Guo[1]

1 *Institute of Entomology, Guizhou University, Guizhou Provincial Key Laboratory for Plant Pest Management of the Mountainous Region, the Scientific Observing and Experimental Station of Crop Pest in Guiyang, Ministry of Agriculture, China, Guiyang 550025, China*

Corresponding author: Jian-Jun Guo (jjguo@gzu.edu.cn)

Academic editor: Vladimir Pesic | Received 27 March 2020 | Accepted 1 June 2020 | Published 5 August 2020

http://zoobank.org/AB18D541-08E8-49DA-B543-7D2F127A4E82

Citation: Gu X-Y, Jia L, Jin D-C, Guo J-J (2020) Contributions to Chinese fauna of Torrenticolidae Piersig, 1902 (Acari, Hydrachnidia), with the description of three new species. ZooKeys 955: 97–111. https://doi.org/10.3897/zookeys.955.52584

Abstract

Five species of torrenticolid mites (Acari, Hydrachnidia), collected in the Anzihe and Qingliangfeng national nature reserves, R. P. China, are identified. Three species are described as new to science: *Torrenticola pseudosiamis* Gu & Guo, **sp. nov.**, *T. anziensis* Gu & Guo, **sp. nov.**, and *Monatractides sichuanensis* Gu & Guo, **sp. nov.** The other two species, *M. macrocorpis* Gu & Guo, 2019, *M. xiaoxiensis* Gu & Guo, 2019, are newly reported from Zhejiang Province. Descriptions and illustrations of these species are included.

Keywords

China, morphology, running waters, taxonomy, torrenticolid mites, water mites

Introduction

China is rich in ecological diversity and types of water bodies, which suggests that a rich species diversity of water mites is expected in the Chinese fauna. In the number of species, the family Torrenticolidae is one of the largest groups of water mites. Until now, the total number of torrenticolid mites is about 600 worldwide, but only 38 species are known from China, including the three new species added in this paper (Gu et al. 2019a, 2020a, b, c; Gu and Guo 2019). This means that the Chinese torrenticolid

Copyright *Xin-Yao Gu et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

mites fauna is largely unknown, and the identification of Chinese torrenticolid species will be a focus in the near future.

In this paper, five species of Torrenticolidae are identified from two national nature reserves in China, Anzihe National Nature Reserve in Sichuan Province and Qingliangfeng National Nature Reserve in Zhejiang Province. Three of these species are new to science: *Torrenticola pseudosiamis* Gu & Guo, sp. nov., *T. anziensis* Gu & Guo, sp. nov., and *Monatractides sichuanensis* Gu & Guo, sp. nov. The other two are newly reported from Zhejiang Province: *M. macrocorpis* Gu & Guo, 2019 and *M. xiaoxiensis* Gu & Guo, 2019. These five species are described and illustrated here.

Material and methods

Water mites were collected, preserved, cleaned, and mounted following the usual methods (Jin 1997; Ding et al. 2019).

The following abbreviations are used (Jin 1997; Wiles 1997; Goldschmidt 2007; Zhang 2018): aL = apical length; Ap = anal pore; bs = basal segment of chelicera; Cx-I–Cx-IV = coxae I–IV; dL = dorsal length; I-L-1–6, etc. = first leg's segment 1–6, etc.; L = length; mL = medial length; Gf = genital field; GUGC = Institute of Entomology, Guizhou University, Guiyang, China; P-1–5 = palp segment 1–5; vL = ventral length; W = width. The chaetotaxy used follows Jin (1997): A_2 = postantennal glandularia; D_1–D_4 = dorsoglandularia 1–4; E_2, E_4 = epimeroglandularia 2, 4; L_1–L_4 = lateroglandularia 1–4; O_2 = postocularia; V_1–V_4 = ventroglandularia 1–4; 4+1 = five plates: four anterior platelets and a single large dorsal plate.

All measurements of palp and legs are of the dorsal margin, given in micrometers (μm) and following Goldschmidt (2007). All the specimens examined are kept in GUGC (no. ZJ-TO-20180701–ZJ-TO-20180709, SC-TO-20160701–SC-TO-20160704).

Taxonomy

Class Arachnida Lamarck, 1801
Order Trombidiformes Reuter, 1909
Family Torrenticolidae Piersig, 1902
Subfamily Torrenticolinae Piersig, 1902
Genus *Torrenticola* Piersig, 1896

***Torrenticola pseudosiamis* Gu & Guo, sp. nov.**
http://zoobank.org/C8F4222B-E74D-4A0E-BE01-80751961123F
Figures 1, 2

Material examined. ***Holotype*:** ♀ (ZJ-TO-20180701), Qingliangfeng National Nature Reserve, Lin'an, Zhejiang Province, P. R. China (30°6'44"N, 118°53'36"E,

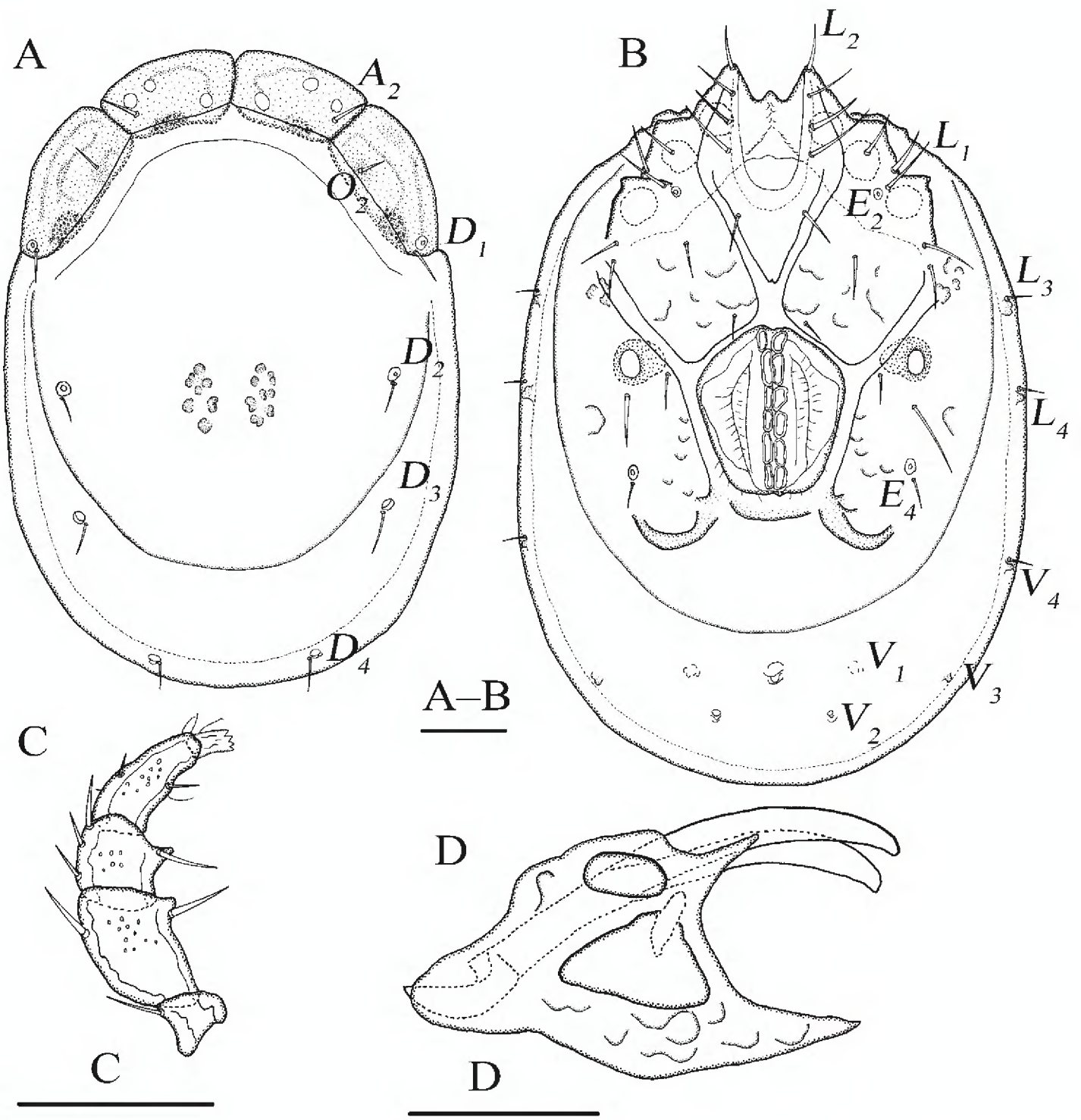

Figure 1. *Torrenticola pseudosiamis* Gu & Guo, sp. nov., female **A** dorsal view **B** ventral view **C** palp, lateral view **D** infracapitulum and chelicera. Scale bars: 100 μm.

940 m a.s.l.), collected by Xinyao Gu, 31-VII-2018. ***Paratype*:** 2 ♀♀ (ZJ-TO-20180702, ZJ-TO-20180703), same data as holotype.

Diagnosis. Idiosoma elliptical; dorsal plate 4+1; infracapitular bay U-shaped; E_4 at the same level as the 6th pair of acetabula; gnathosoma with a short rostrum, the lateral view of gnathosoma regular triangle-like.

Description. Female (*n* = 3): Idiosoma elliptical, L 847 (774–887), W 586 (586–648), L/W ratio 1.4 (1.3–1.4). Dorsal plate 4+1 (Fig. 1A), dorsal shield L 755 (682–770), W 530 (530–585), dorsal plate L 694 (620–709), frontal platelets L 158 (152–170), W 83 (69–90), shoulder platelets L 169 (169–196), W 99 (81–99). Infracapitular bay U-shaped, depth 126 (126–150); only the tip of Cx-I exceeding to the anterior margin of idiosoma; Cx-I L 270 (230–273), mL 123 (102–123), Cx-

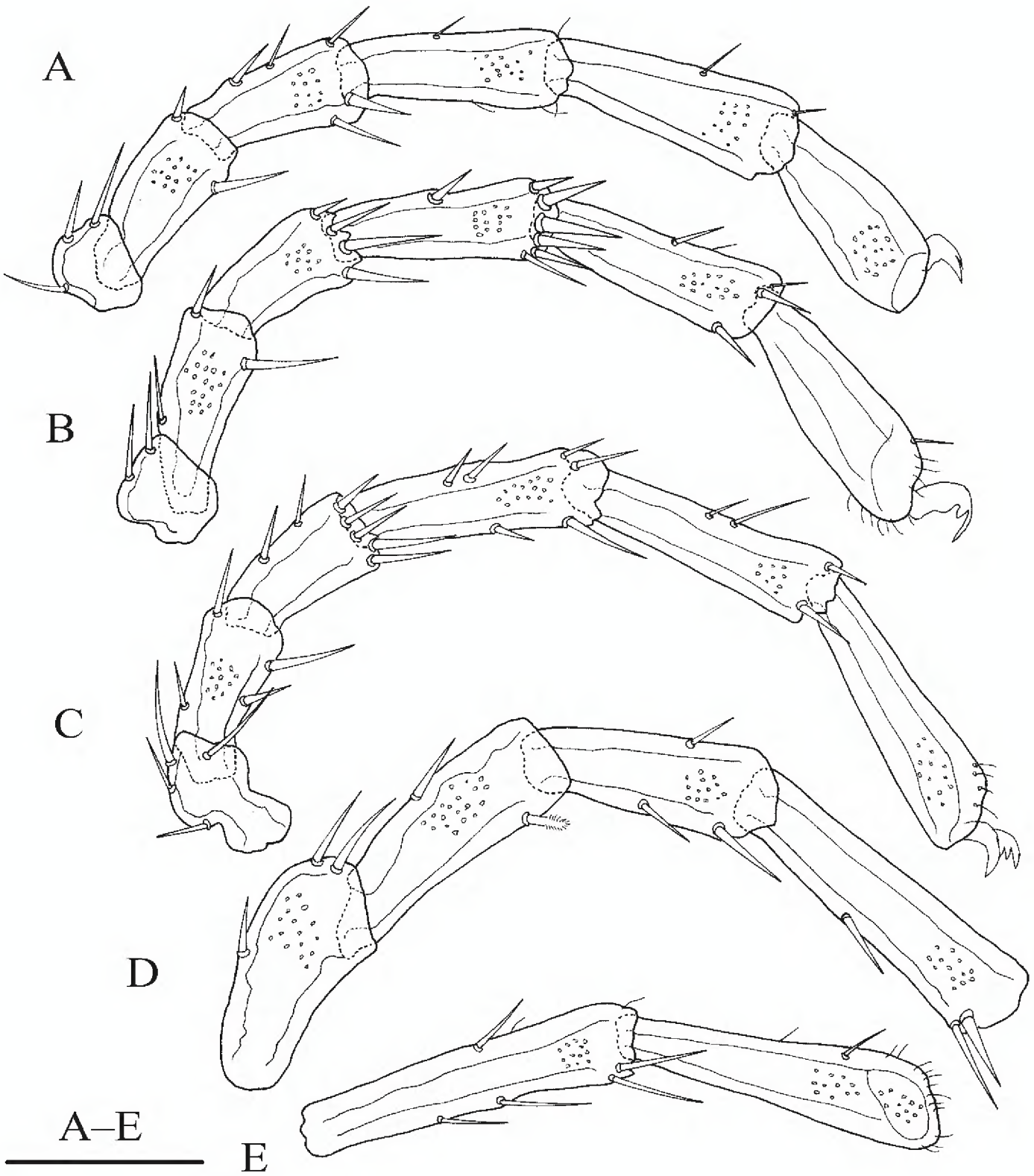

Figure 2. *Torrenticola pseudosiamis* Gu & Guo, sp. nov., female **A** leg-I **B** leg-II **C** leg-III **D** leg-IV-1–4 **E** leg-IV-5–6. Scale bar: 100 μm.

II+III mL 33 (19–33); Gf pentagonal, L 220 (180–220), W 168 (168–192), L/W ratio 1.3 (1.1–1.3), distance between Gf and Ap 220 (156–220); E_4 at the same level as the 6th pair of acetabula; Ap away from the line of primary sclerotization, on the same level of V_1 and anterior to V_2 (Fig. 1B). Gnathosoma (Fig. 1D): the lateral view of gnathosoma regular triangle-like; vL 231 (200–242), dL 151 (128–159), chelicera bs L 214 (202–251), claw L 41 (41–43). P-1 with one dorsal seta; P-2 with one dorsal and one ventral setae at the base of the ventral extension; P-3 with three dorsal setae and one long seta at the base of the ventral extension; P-4 with one dorsal seta in proximal half,

two mediodistal setae and two ventral setae at the slight ventral extension (Fig. 1C). dL of palp segments: P-1, 27 (26–30); P-2, 68 (65–68); P-3, 41 (37–48); P-4, 62 (59–72); P-5, 20 (19–25). Legs (Fig. 2): dL of leg segments: I-L-1–6: 64 (64–74), 86 (86–87), 84 (82–92), 109 (105–123), 124 (116–124), 125 (115–125); II-L-1–6: 51 (44–51), 92 (89–116), 78 (76–86), 110 (110–132), 129 (129–149), 132 (127–142); III-L-1–6: 73 (54–73), 80 (80–108), 82 (72–86), 123 (105–123), 139 (107–139), 146 (121–146); IV-L-1–6: 126 (115–134), 119 (111–123), 118 (112–133), 169 (157–185), 169 (165–192), 167 (148–174).

Male. Unknown.

Habitat. Streamlet.

Remarks. Due to the characteristic shape of gnathosoma and dorsal shield (i.e., gnathosoma with a short rostrum, the lateral view of gnathosoma regular triangle-like), this new species is similar to *Torrenticola siamis* Pešić & Smit, 2009 (Pešić and Smit 2009). However, there are obvious differences between them: (1) only the tip of Cx-I exceeding to the anterior margin of idiosoma in this new species, but the tip of Cx-I and Cx-II exceeding in *T. siamis*; (2) E_4 at the same level as the 6th pair of acetabula in the new species, but the 4th pair in *T. siamis*; (3) D_2 on the same level with muscle scars in the new species, but D_2 anterior to muscle scars in *T. siamis*.

Etymology. The specific name is from Latin affix: "*pseudo-*", which means fake or simulated; this new species is named after its similar species, *T. siamis*.

Distribution. China (Zhejiang).

***Torrenticola anziensis* Gu & Guo, sp. nov.**

http://zoobank.org/2BB83E40-0117-4BD6-8205-AF3A754EBD6B

Figures 3, 4

Material examined. ***Holotype*:** ♀ (SC-TO-20160701), Anzihe, Chongzhou, Sichuan Province, P. R. China (30°47'43"N, 103°12'36"E, 1690 m a.s.l.), collected by Zhuhui Ding, 29-VII-2016. ***Paratype*:** 1 ♀ (SC-TO-20160702), same data as holotype.

Diagnosis. Dorsal plate 4+1; infracapitular bay U-shaped and wide; genital flaps with six pairs of setae at the margins; E_4 at the same level as the 3rd pair of acetabula; V_1 fused with the line of primary sclerotization; gnathosoma: rostrum long, dorsal apodemes short and sharp, ventral apodemes slender and sharp, claw short.

Description. Female (*n* = 2): Idiosoma elliptical, L 840 (836), W 583 (576), L/W ratio 1.4 (1.5). Dorsal plate 4+1 (Fig. 3A), dorsal shield L 680 (668), W 520 (505), dorsal plate L 617 (602), frontal platelets L 162 (158), W 78 (76), shoulder platelets L 220 (218), W 87 (89). Infracapitular bay U-shaped and wide, depth 175 (162); Cx-I L 317 (315), mL 83 (81), Cx-II+III mL 99 (89); Gf L 200 (208), W 140 (144), L/W ratio 1.4 (1.4), genital flaps with six pairs of setae at the margins; distance between Gf and Ap 123 (134); E_4 at the same level as the 3rd pair of acetabula; Ap on the same line with V_2, V_1 fused with the line of primary sclerotization, and V_1 anterior to V_2 (Fig. 3B). Gnathosoma (Fig. 3D): rostrum long, dorsal apodemes short and sharp,

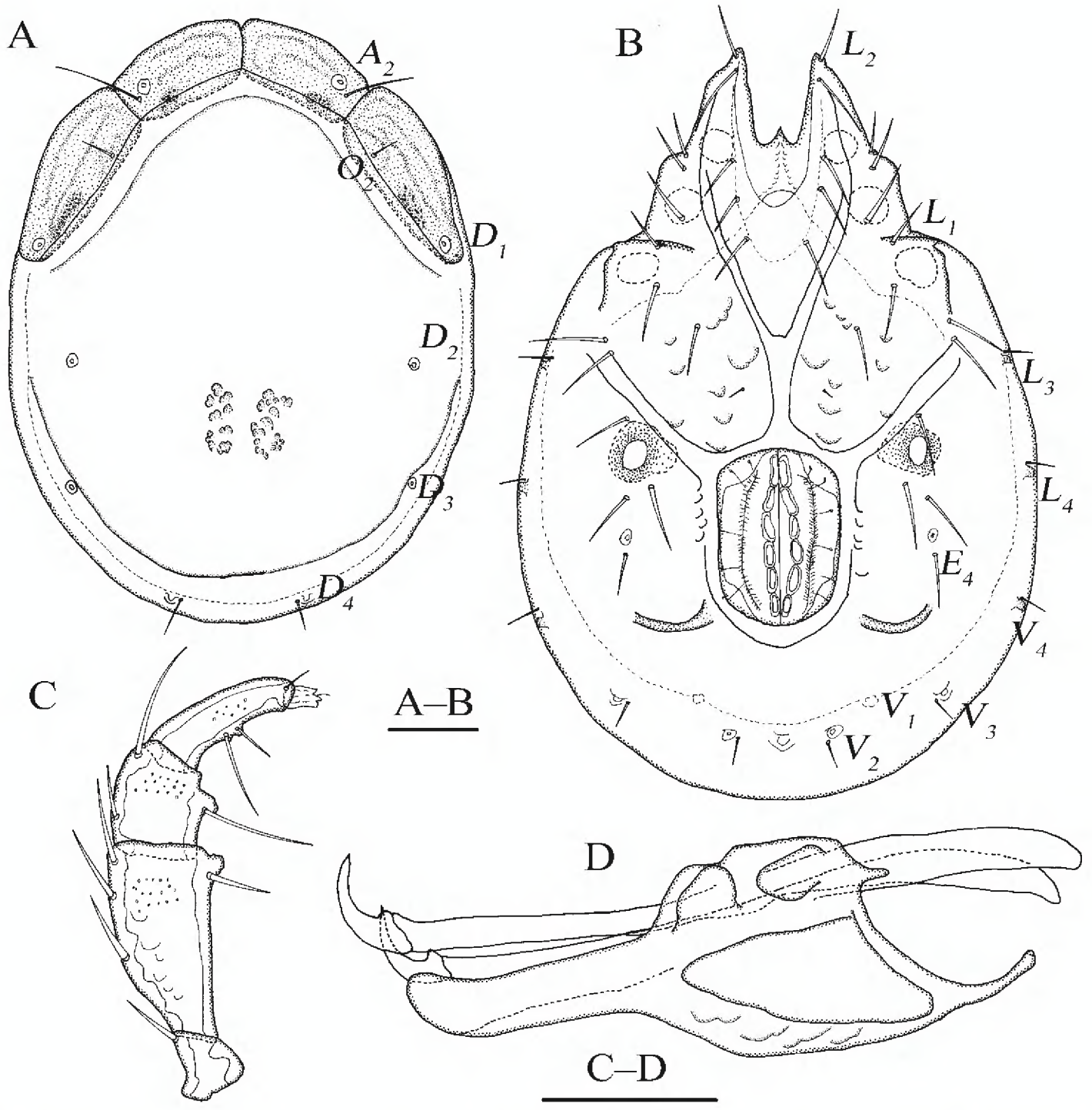

Figure 3. *Torrenticola anziensis* Gu & Guo, sp. nov., female **A** dorsal view **B** ventral view **C** palp, lateral view **D** infracapitulum and chelicera. Scale bars: 100 μm.

ventral apodemes slender and sharp, claw short; vL 355 (336), dL 256 (242); chelicera bs L 378 (369), claw L 63 (58). P-1 with one long dorsal seta; P-2 with three dorsal setae and one ventral seta at the base of the ventral extension; P-3 with two dorsal setae and one long seta at the base of the ventral extension; P-4 with one mediodistal seta and two ventral setae at two ventral extensions (Fig. 3C). dL of palp segments: P-1, 42 (39); P-2, 113 (109); P-3, 67 (66); P-4, 93 (95); P-5, 18 (16). Legs (Fig. 4): dL of leg segments: I-L-1–6: 44 (39), 95 (102), 88 (85), 102 (108), 110 (116), 96 (101); II-L-1–6: 43 (45), 98 (102), 93 (94), 121 (118), 136 (129), 149 (139); III-L-1–6: 43 (45), 98 (102), 81 (85), 101 (108), 117 (115), 114 (121); IV-L-1–6: 107 (102), 118 (115), 125 (119), 161 (158), 179 (183), 166 (171).

Male. Unknown.

Habitat. Streamlet.

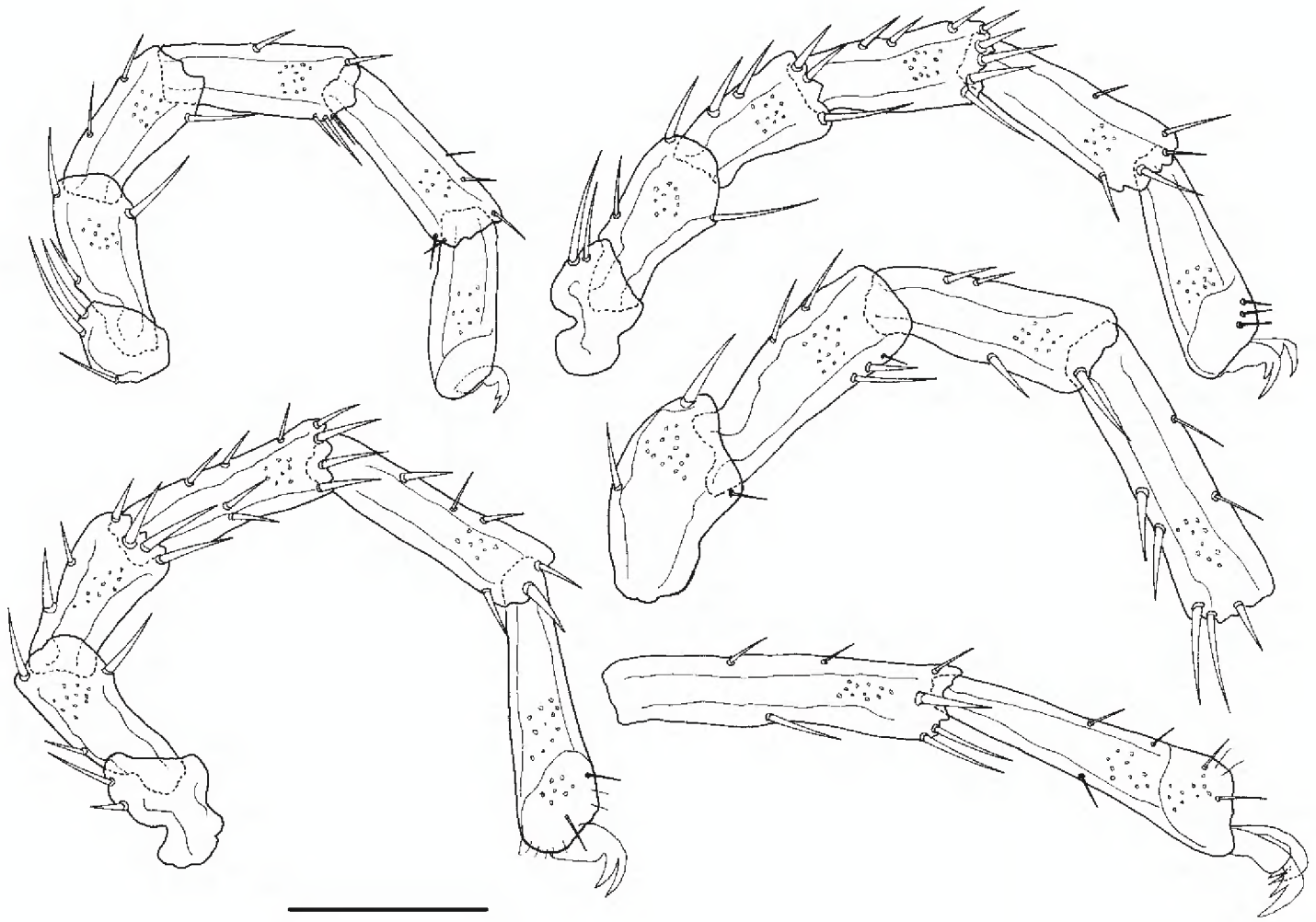

Figure 4. *Torrenticola anziensis* Gu & Guo, sp. nov., female **A** leg-I **B** leg-II **C** leg-III **D** leg-IV-1–4 **E** leg-IV-5, 6. Scale bar: 100 μm.

Remarks. Due to the characteristic shape of gnathosoma and dorsal shield (i.e., gnathosoma with a long rostrum, dorsal and ventral apodemes sharp), this new species is similar to *Torrenticola haliki* Pešić & Smit, 2010 (Pešić and Smit 2010). However, there are obvious differences between them: (1) ventral projection of P-2 nose-shaped in *T. haliki*, but normally shaped in this new species; (2) P-4 with one long and three short setae at the base of ventral extensions and one thick mediodistal seta in *T. haliki*, but only with two ventral setae and one fine mediodistal seta in this new species; (3) ratio Cx-I mL/Cx-II+III mL 1.2 (male), 1.7–2.3 (female) in *T. haliki*, but 0.8 (female) in this new species.

Etymology. This new species is named after Anzi (Anzi River), where the new species was collected.

Distribution. China (Sichuan).

Genus *Monatractides* (K. Viets, 1926)

Monatractides sichuanensis Gu & Guo, sp. nov.

http://zoobank.org/8EFE370B-7D4D-46B4-9D87-2608AE618101

Figures 5, 6

Material examined. ***Holotype*:** ♀ (SC-TO-20160703), Anzihe National Nature Reserve, Chongzhou, Sichuan Province, P. R. China (30°47'43"N, 103°12'36"E,

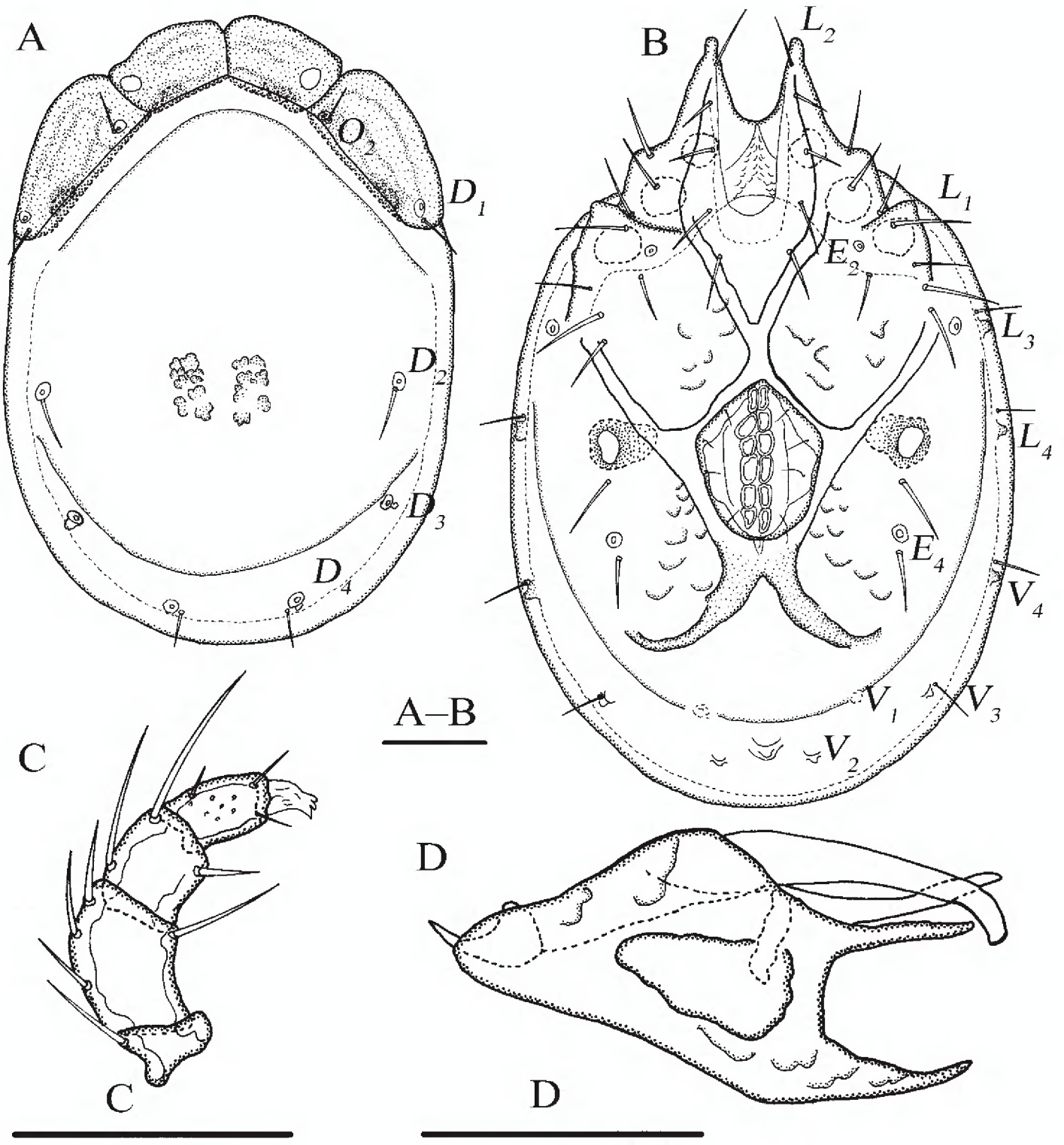

Figure 5. *Monatractides sichuanensis* Gu & Guo, sp. nov., female **A** dorsal view **B** ventral view **C** palp, lateral view **D** infracapitulum and chelicera. Scale bars: 100 μm.

1690 m a.s.l.), collected by Zhuhui Ding, 29-VII-2016. ***Paratype*:** 1 ♀ (SC-TO-20160704), same data as holotype.

Diagnosis. Infracapitular bay U-shaped and wide; the tip of Cx-I with a papillary cuticular extension, E_4 at the same level as the posterior margins of Gf; V_1 fused with the line of primary sclerotization; D_2 on the same level with muscle scars; dorsal and ventral apodemes of gnathosoma slender and sharp; dorsal seta on P-1 long.

Description. Female (*n* = 2): Idiosoma elliptical, L 749 (715), W 497 (469), L/W ratio 1.5 (1.5). Dorsal plate 4+1 (Fig. 5A), dorsal shield L 628 (586), W 438 (536), dorsal plate L 584 (423), frontal platelets L 118 (120), W 57 (68), shoulder platelets

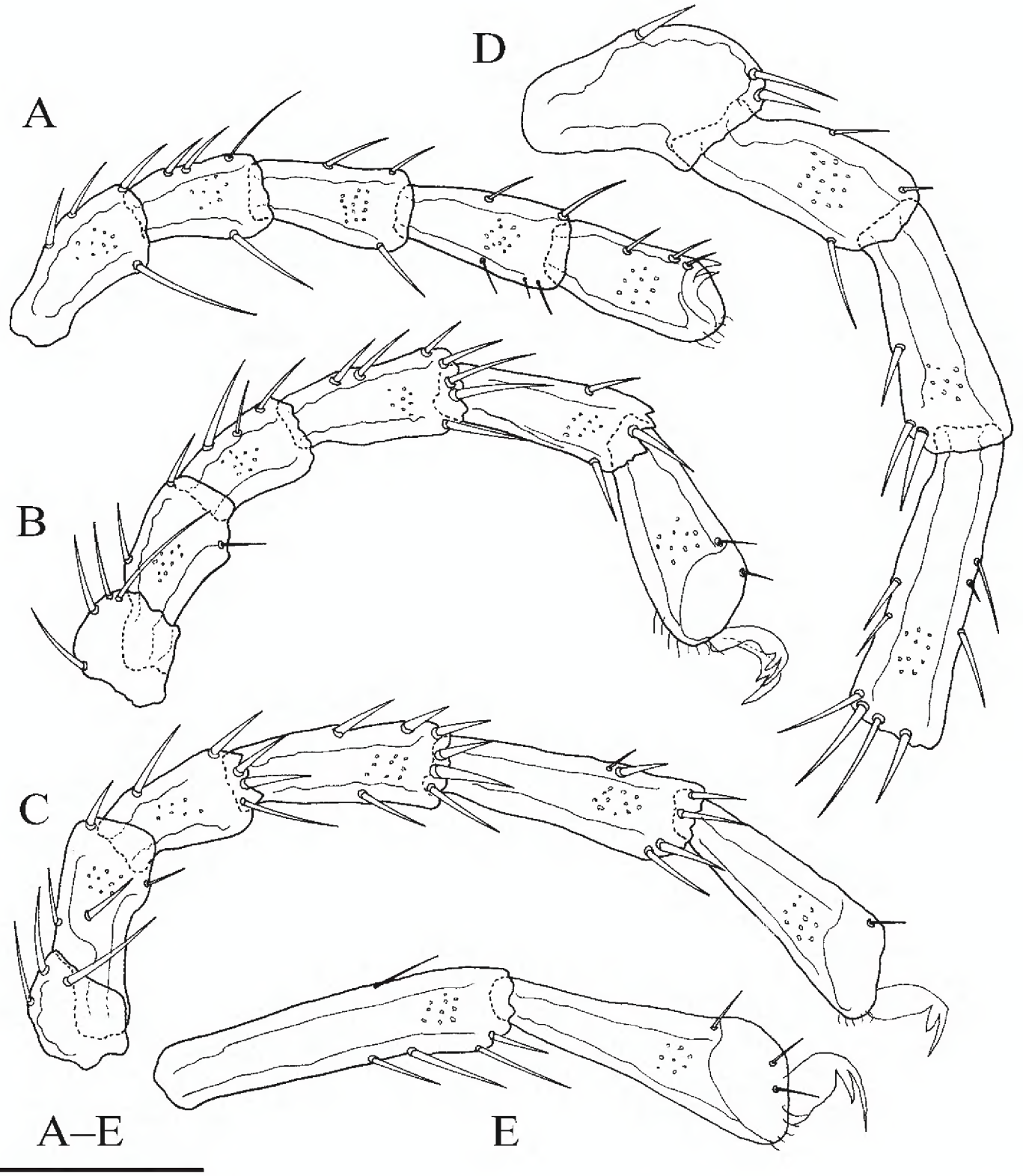

Figure 6. *Monatractides sichuanensis* Gu & Guo, sp. nov., female **A** leg-I **B** leg-II **C** leg-III **D** leg-IV-1–4 **E** leg-IV-5, 6. Scale bar: 100 μm.

L 174 (157), W 80 (75). Infracapitular bay U-shaped and wide, depth 171 (163); the margins of Cx-II and Cx-III blunt and flat, the tip of Cx-I with a papillary cuticular extension, Cx-I L 292 (266), mL 123 (102), Cx-II+III mL 46 (31); Gf pentagonal, L 156 (159), W 122 (109), L/W ratio 1.3 (1.5), genital flaps with six pairs of setae at the margins; distance between Gf and Ap 222 (181); E_4 at the same level as the posterior margins of Gf; V_1 fused with the line of primary sclerotization, Ap at the same line with V_2 (Fig. 5B). Gnathosoma (Fig. 5D) vL 182 (177), dL 177 (116); dorsal and ventral apodemes slender and sharp; claw short, chelicera bs L 159 (162), claw L 27 (22). P-1

with one long dorsal seta; P-2 with three dorsal and one ventral setae; P-3 with two long dorsal setae and one short ventral seta; P-4 with one short dorsal seta and two mediodistal setae (Fig. 5C). dL of palp segments: P-1, 21 (25); P-2, 52 (48); P-3, 34 (32); P-4, 34 (39); P-5, 17 (14). Legs (Fig. 6): dL of leg segments: I-L-1–6: 57 (46), 70 (71), 59 (62), 67 (80), 58 (72), 79 (83); II-L-1–6: 55 (61), 92 (85), 56 (60), 86 (75), 84 (92), 108 (96); III-L-1–6: 63 (51), 99 (92), 71 (69), 94 (95), 118 (112), 120 (115); IV-L-1–6: 113 (115), 97 (87), 115 (111), 138 (140), 151 (126), 144 (142).

Male. Unknown.

Habitat. Streamlet.

Remarks. This new species is similar to *Monatractides harveyi* Pešić & Smit, 2012 (Pešić and Smit 2012) in the general shape of gnathosoma, but differs in: (1) P-4 with small denticles near the insertion of the ventral setae in *M. harveyi*, but smooth in the new species; (2) the margins of Cx-II and Cx-III sharp in *M. harveyi*, but blunt and flat in the new species; (3) D_2 anterior to muscle scars in *M. harveyi*, but D_2 on the same level with muscle scars in the new species.

Etymology. This new species is named after Sichuan Province, where it was collected.

Distribution. China (Sichuan).

Monatractides macrocorpis Gu & Guo, 2019

Figures 7, 8

Material examined. Qingliangfeng National Nature Reserve, Lin'an, Zhejiang Province, P. R. China (30°6'44"N, 118°53'36"E, 940 m a.s.l.), collected by Xinyao Gu, 31-VII-2018, 1 ♀(ZJ-TO-20180704), 2 ♂♂ (ZJ-TO-20180705, ZJ-TO-20180706).

Morphology. Male (*n* = 1): Idiosoma L 1083, W 833, L/W ratio 1.3. Dorsal plate 4+1 (Fig. 7A) with a red colour patterns, dorsal shield L 898, W 749, dorsal plate L 804, frontal platelets L 181, W 103, shoulder platelets L 254, W 115. Infracapitular bay U-shaped, depth 206; Cx-I L 376, mL 177, Cx-II+III mL 65; Gf elongated and oval, L 246, W 188, L/W ratio 1.3; distance between Gf and Ap 206. Gnathosoma (Fig. 7D) vL 231, dL 158; dorsal apodeme blunted and ventral apodeme sharp; chelicera bs L 284, claw L 27. P-1 with one dorsal seta; P-2 with three dorsal and one ventral setae; P-3 with two dorsal and one long ventral setae; P-4 with one ventral seta on the slight ventral extension (Fig. 7C). dL of palp segments: P-1, 34; P-2, 80; P-3, 54; P-4, 74; P-5, 30. Legs: dL of leg segments: I-L-1–6: 70, 129, 114, 147, 144, 125; II-L-1–6: 70, 116, 107, 151, 188, 164; III-L-1–6: 86, 146, 108, 169, 216, 192; IV-L-1–6: 152, 159, 176, 220, 241, 224. Ejaculatory complex: L 326, aL 221.

Female (*n* = 2). Body features same as the male except: Idiosoma L 1212 (1213), W 945 (949), L/W ratio 1.2 (1.3). Dorsal plate (Fig. 8A), dorsal shield L 959 (989), W 871 (845), dorsal plate L 918 (928), frontal platelets L 195 (173), W 109 (96), shoulder platelets L 269 (295), W 123 (117). Infracapitular bay depth 220 (222); Cx-I L 369 (402), mL 145 (176), Cx-II+III mL 68 (38); Gf L 256 (267), W 253 (236), L/W ratio 1.0 (1.1); distance between Gf and Ap 292 (248). Gnathosoma (Fig. 8B) vL

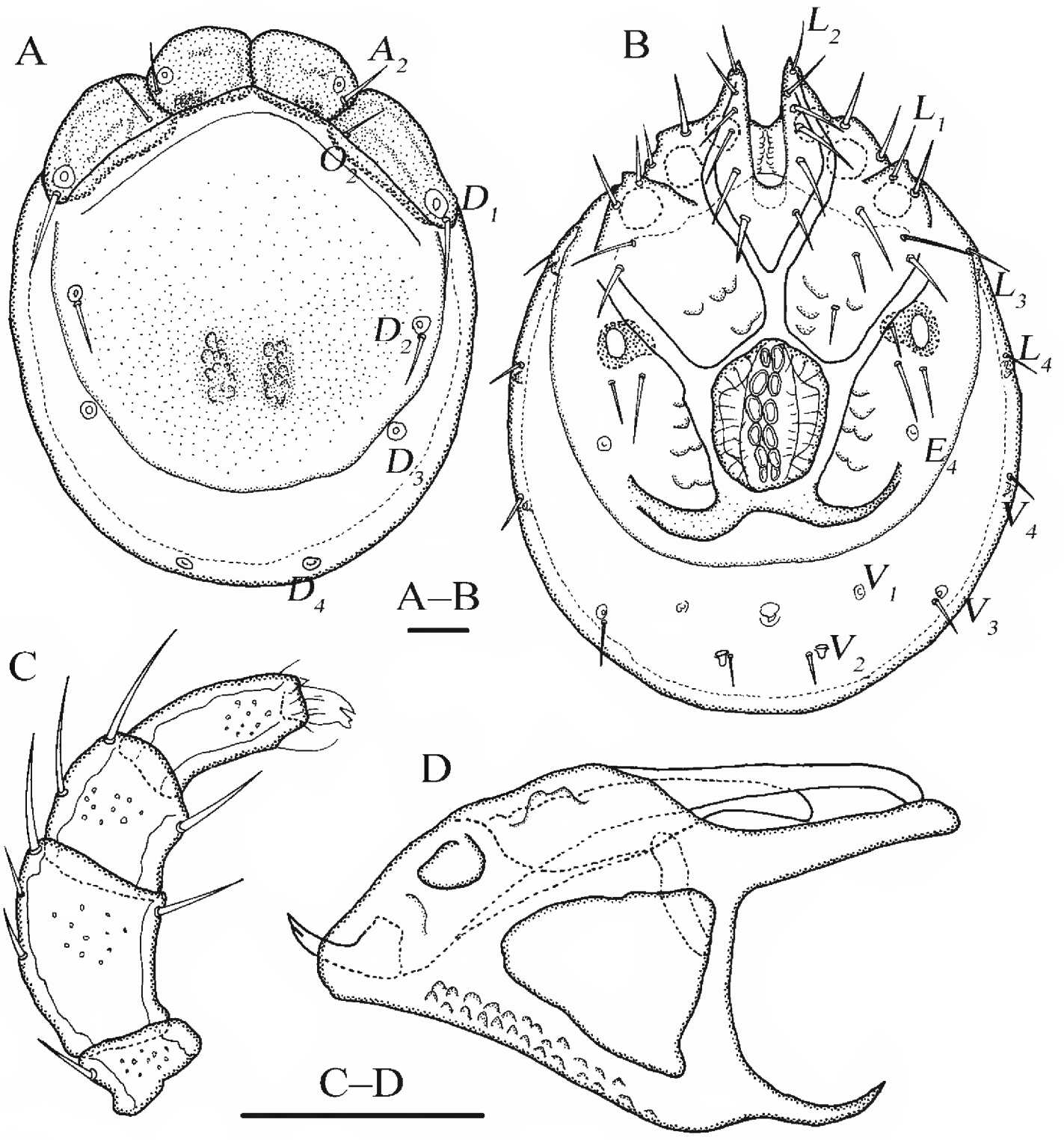

Figure 7. *Monatractides macrocorpis* Gu & Guo, 2019, male **A** dorsal view **B** ventral view **C** palp, lateral view **D** infracapitulum and chelicera. Scale bars: 100 μm.

257 (259), dL 246 (262), claw short L 32 (29), chelicera bs L 246 (262). dL of palp segments: P-1, 32 (34); P-2, 90 (91); P-3, 51 (58); P-4, 77 (83); P-5, 21 (32). Legs: dL of leg segments: I-L-1–6: 100 (77), 114 (137), 121 (120), 153 (157), 147 (149), 127 (123); II-L-1–6: 90 (78), 134 (148), 99 (98), 154 (175), 195 (203), 168 (176); III-L-1–6: 101 (-), 161 (170), 119 (120), 177 (193), 214 (228), 217 (203); IV-L-1–6: 144 (159), 181 (160), 188 (192), 235 (243), 245 (261), 230 (220).

Habitat. Streamlet.

Remarks. The populations from Zhejiang Province fit the definition of *Monatractides macrocorpis* Gu & Guo, 2019 (Gu et al. 2019b). Differences with the original description are: (1) the ventral apodeme of gnathosoma, sharp in Zhejiang specimens,

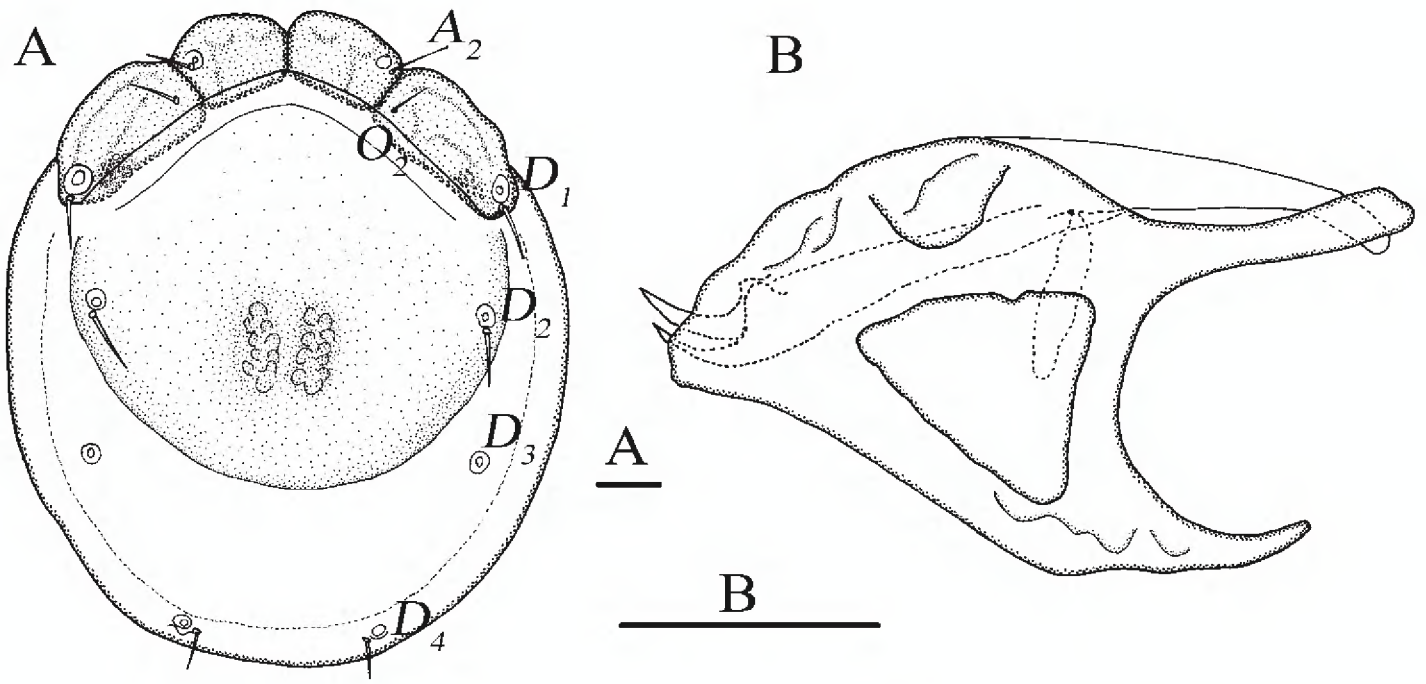

Figure 8. *Monatractides macrocorpis* Gu & Guo, 2019, female **A** dorsal view **B** infracapitulum and chelicera. Scale bars: 100 μm.

but blunt in Hunan specimens; (2) with a red colour pattern in Zhejiang specimens, but purple in Hunan specimens.

Distribution. China (Hunan, Zhejiang).

Monatractides xiaoxiensis Gu & Guo, 2019

Figure 9

Material examined. Qingliangfeng National Nature Reserve, Lin'an, Zhejiang Province, P. R. China (30°6'12"N, 118°55'12"E, 440 m a.s.l.), female, collected by Xinyao Gu, 31-VII-2018, 3 ♀♀ (ZJ-TO-20180707 – ZJ-TO-20180709).

Morphology. Female (*n* = 3): Idiosoma elliptical, L 741 (722–762), W 473 (472–491), L/W ratio 1.6 (1.5–1.6). Dorsal plate 4+1 (Fig. 9A), dorsal shield L 631 (595–656), W 428 (413–441), dorsal plate L 567 (541–579), frontal platelets trapezoidal, L 131 (120–138), W 62 (62–74), shoulder platelets triangular, L 155 (142–155), W 76 (72–79). Infracapitular bay depth 134 (134–150); Cx-I L 269 (244–269), mL 133 (92–133), Cx-II+III mL 37 (37–42); Gf L 132 (132–151), W 116 (115–118), L/W ratio 1.1 (1.1–1.3), distance between Gf and Ap 197 (197–217); Ap away from the line of primary sclerotization, on the same line with V_1 and anterior to V_2 (Fig. 9B). Gnathosoma (Fig. 9C) vL 152 (152–173), dL 117 (113–121); claw short L 23 (19–23), chelicera bs L 159 (159–172). dL of palp segments: P-1, 23 (20–23); P-2, 52 (43–52); P-3, 34 (34–38); P-4, 44 (43–44); P-5, 15 (15–19). dL of leg segments: I-L-1–6: 66 (60–66), 71 (71–81), 76 (67–76), 97 (90–98), 97 (94–97), 92 (88–94); II-L-1–6: 63 (58–63), 80 (72–85), 68 (60–76), 93 (88–93), 107 (96–107), 109 (107–115); III-L-1–6: 54 (54–58), 93 (87–93), 71 (71–74), 99 (97–109), 127 (114–127), 117

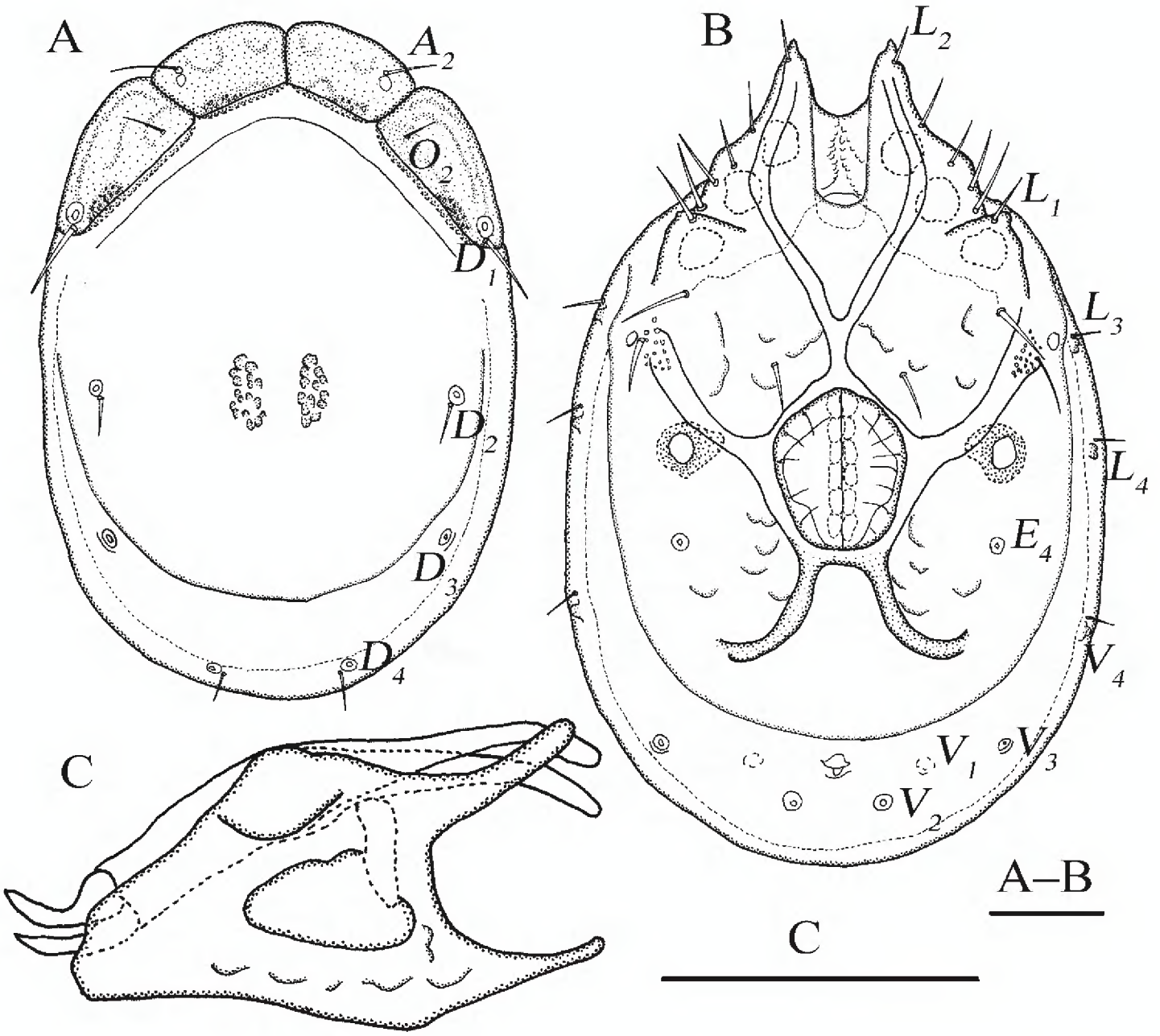

Figure 9. *Monatractides xiaoxiensis* Gu & Guo, 2019, female **A** dorsal view **B** ventral view **C** infracapitulum and chelicera. Scale bars: 100 μm.

(112–127); IV-L-1–6: 102 (99–114), 94 (88–108), 115 (109–118), 145 (133–154), 154 (151–156), 147 (135–149).

Male. Unknown.

Habitat. Streamlet.

Remarks. The specimens match the general morphology of *Monatractides xiaoxiensis* Gu & Guo, 2019, a species from China (Gu et al. 2019b). *Monatractides xiaoxiensis* is characterized by: frontal platelets trapezoidal, shoulder platelets triangular; only the tip of Cx-I and Cx-II exceeding to the anterior margin of idiosoma; tips of Cx-I with an elongated cuticle extension; gnathosoma dorsal apodeme long with a blunt end, ventral apodeme pointed and bent towards dorsum; bs curved heavily towards ventrum (Gu et al. 2019b). According to these characters, we believe our specimens from Zhejiang Province are *M. xiaoxiensis*. The only differences are found in V_4, which is away from the line of primary sclerotization in Zhejiang specimens, but close to the line in Hunan specimens.

Distribution. China (Hunan, Zhejiang).

Acknowledgements

Special thanks are given to Zhuhui Ding (Institute of Entomology, Guizhou University, P. R. China) for the collection of the specimens. This research was supported by Guizhou Science and Guizhou Graduate Research Fund Project No. Qianjiaohe YJSCXJH [2019]105, National Natural Science Foundation of China No. 31772421, 31750002, Technology Project No. Qiankehe Pingtai Rencai [2017]5788, Xinyao Gu is supported by a scholarship from the China Scholarship Council (CSC201906670003).

References

Ding ZH, Guo JJ, Yi TC, Jin DC (2019) New water mites of the genus *Neumania* (Acari, Hydrachnidia: Unionicolidae) from China. Systematic and Applied Acarology 24(1): 1–15. https://doi.org/10.11158/saa.24.1.1

Goldschmidt T (2007) Studies on Latin American water mites of the genus *Torrenticola* Piersig, 1896 (Torrenticolidae, Hydrachnidia, Acari). Zoological Journal of the Linnean Society 150: 443–678. https://doi.org/10.1111/j.1096-3642.2007.00305.x

Gu XY, Guo JJ (2019) Five new species of genera *Torrenticola* and *Monatractides* (Acari, Hydrachnidia, Torrenticolidae) from Hainan Island, China. Systematic and Applied Acarology 24(12): 2460–2482. https://doi.org/10.11158/saa.24.12.12

Gu XY, Jin DC, Yi TC, Guo JJ (2019a) Contributions to the knowledge of torrenticolid water mites (Acari: Hydrachnidia) in Doupengshan, China. Zootaxa 4695(2): 101–121. https://doi.org/10.11646/zootaxa.4695.2.1

Gu XY, Jin DC, Yi TC, Guo JJ (2019b) Taxonomic notes on genus *Monatractides* K. Viets 1926 (Acari, Hydrachnidia, Torrenticolidae) from China. International Journal of Acarology 45(5): 293–306. https://doi.org/10.1080/01647954.2019.1622593

Gu XY, Jin DC, Guo JJ (2020a) Three new species and one new record of Torrenticolidae (Acari, Hydrachnidia) from Wuyishan with an updated key for Chinese fauna. European Journal of Taxonomy 625: 1–23. https://doi.org/10.5852/ejt.2020.625

Gu XY, Jia L, Jin DC, Guo JJ (2020b) Four new species of Torrenticola (Acari, Hydrachnidia, Torrenticolidae) from northeastern China. Zootaxa 4779(2): 245–259. https://doi.org/10.11646/zootaxa.4779.2.6

Gu XY, Jia L, Jin DC, Guo JJ (2020c) New water mites of Torrenticolidae (Acari, Hydrachnidia) from Jiangxi Province, P. R. China. Acarologia 60(2): 488–500. https://doi.org/10.24349/acarologia/20204381

Jin DC (1997) Hydrachnellae-Morphology Systematics a Primary Study of Chinese Fauna. Guizhou Science and Technology Publishing House, Guiyang, 356 pp. [in Chinese]

Pešić V, Smit H (2009) Water mites of the family Torrenticolidae Piersig, 1902 (Acari: Hydrachnidia) from Thailand, Part I. The genera *Torrenticola* Piersig, 1896, *Neoatractides* Lundblad, 1941 and *Pseudotorrenticola* Walter, 1906. Zootaxa 1982: 38–62. https://doi.org/10.11646/zootaxa.1982.1.2

Pešić V, Smit H (2010) New records of water mites (Acari: Hydrachnidia) from Malaysia, with descriptions of three new species. Zootaxa 2354(1): 19–34. https://doi.org/10.11646/zootaxa.2354.1.2

Pešić V, Smit H (2012) Water mites of the genus *Monatractides* (Acari: Hydrachnidia, Torrenticolidae) from Australia, with descriptions of four new species. Zootaxa 3248(1): 1–24. https://doi.org/10.11646/zootaxa.3248.1.1

Wiles PR (1997) Asian and Oriental Torrenticolidae Piersig, 1902 (Acari: Hydrachnidia: Lebertioidea): a revision of the family and description of new species of *Torrenticola* Piersig and *Pseudotorrenticola* Walter, from Southeast Asia. Journal of Natural History 31: 191–236. https://doi.org/10.1080/00222939700770121

Zhang ZQ (2018) Repositories for mite and tick specimens: acronyms and their nomenclature. Systematic and Applied Acarology 23(12): 2432–2446. https://doi.org/10.11158/saa.23.12.12